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The settlement of the dispute in the London area of the printing trades was too late for us to take full advantage of the resumption of work. We again apologise to our readers for the omission of many regular features. Full services will be restored at the earliest opportunity

Printing Trade Dispute Settled

THE lengthy dispute over wage increases between the London Master Printers' Association and the London Society of Compositors, which was responsible in May for a ban on overtime and, in August, restrictions on working, culminated in a stoppage in a number of London printing works lasting from August 30 to September 12. Publication of *The Railway Gazette* was maintained only in conditions of the greatest difficulty. Delay in publication of the September 1 and 8 issues was unavoidable, and the present issue also is slightly late in appearing. The issues affected were necessarily abridged and we have had to ask our readers to overlook shortcomings and the exclusion of some familiar features. We hope that in the next issue, dated September 22, we shall have reverted to our normal standard and number of pages, and that current topics on which we have been unable to comment, because of the impossibility of having new matter set up, will be adequately covered. One of the most important events of this month is the fifteenth session of the International Railway Congress, which opens in Rome on September 25, and appearing in this issue is an illustrated article in which Signor G. di Raimondo, Director-General of the Italian State Railways, describes the remarkable recovery which that system has made from wartime devastation.

Working on the Norfolk & Western, U.S.A.

IN December the Norfolk & Western Railway introduced two new trains for the "Powhatan Arrow," its principal express, described elsewhere in this issue. The system has some distinctive features. Its main line runs from the Atlantic port of Norfolk, Virginia, westwards across the Allegheny mountains to Cincinnati, where it hands over traffic for Chicago, St. Louis and the Middle West and West. A dense coal traffic is carried from the West Virginia and Kentucky coalfields to the seaboard, and the heaviest mountain section, consisting of 20 miles graded almost continuously at 1 in 50, is electrified. There are other long and severe gradients, notably 1 in 77, demanding a high standard of motive power. It is significant therefore that the Norfolk & Western is one of the few lines in the United States which still depend entirely on steam locomotives for both passenger and freight working, apart from the short electrified section. This policy is made possible by the efficiency of the motive power department, especially in its running-shed equipment and methods, and its remarkably serviceable three principal classes of locomotive. These are a 4-8-4 with 80,000-lb. tractive effort, a 2-6-6-4 simple articulated type, with 114,000 lb., and a 2-8-8-2 Mallet compound rated at 152,200 lb. (simple) and 126,800 (compound) tractive effort. The average mileage of a 4-8-4 working the "Powhatan Arrow" from Roanoke westwards is 15,000 miles a month. All these locomotives are designed and built at the railway shops at Roanoke.

Tunnel Removes Bottleneck

THE opening on November 9, 1949, of the new Altamont Tunnel on the Union Pacific main line, which is described elsewhere in this issue, removed another bottleneck in American east-west commercial and strategic traffic. Previously the former single-line Aspen Tunnel which it duplicates was the only break in the continuous 1,000-mile double-line section from Omaha to Salt Lake City. The significance of this $8,000,000 project is not limited to the continuity of the doubling, as the bottleneck which it removes occurred on the 400-mile Cheyenne to Green River section, itself a defile in the Union Pacific system. East of Cheyenne the main line from Omaha is joined by a secondary main line from Denver and Kansas City. At Green River the Union Pacific main lines again bifurcate, one running north-west to Portland and Seattle, and the other to Ogden (whence the Southern Pacific Railroad continues westwards to San Francisco) and south-west to Salt Lake City and Los Angeles. There is thus a concentration of traffic on this section from and to five directions, and it is remarkable that the single-line Aspen Tunnel section has carried it so long.

Iraqi State Railways

THE report of the Iraqi State Railways for the year ending March 31, 1949, which has been sent to us by the Director General, Mr. W. J. Moffatt, states that results of working were affected by adverse conditions in the country and by increased expenditure on wages, and by road transport competition over short distances. The surplus of revenue over expenditure fell short of the estimates, due to reduced revenue from catering and air services. No loans were made during the year by the Iraqi Central Treasury towards capital works embarked on by the State Railways, which had to have recourse to, and eventually exhaust reserve liquid assets by the end of the year. Negotiations for a loan were opened in London, but there was difficulty in financing work in hand by British contractors, and in keeping an adequate balance with the Crown Agents for the Colonies against supplies from Britain. The operating ratio (excluding renewals and so

on) was 91·5 per cent., against 80·9 per cent. for 1947-48.

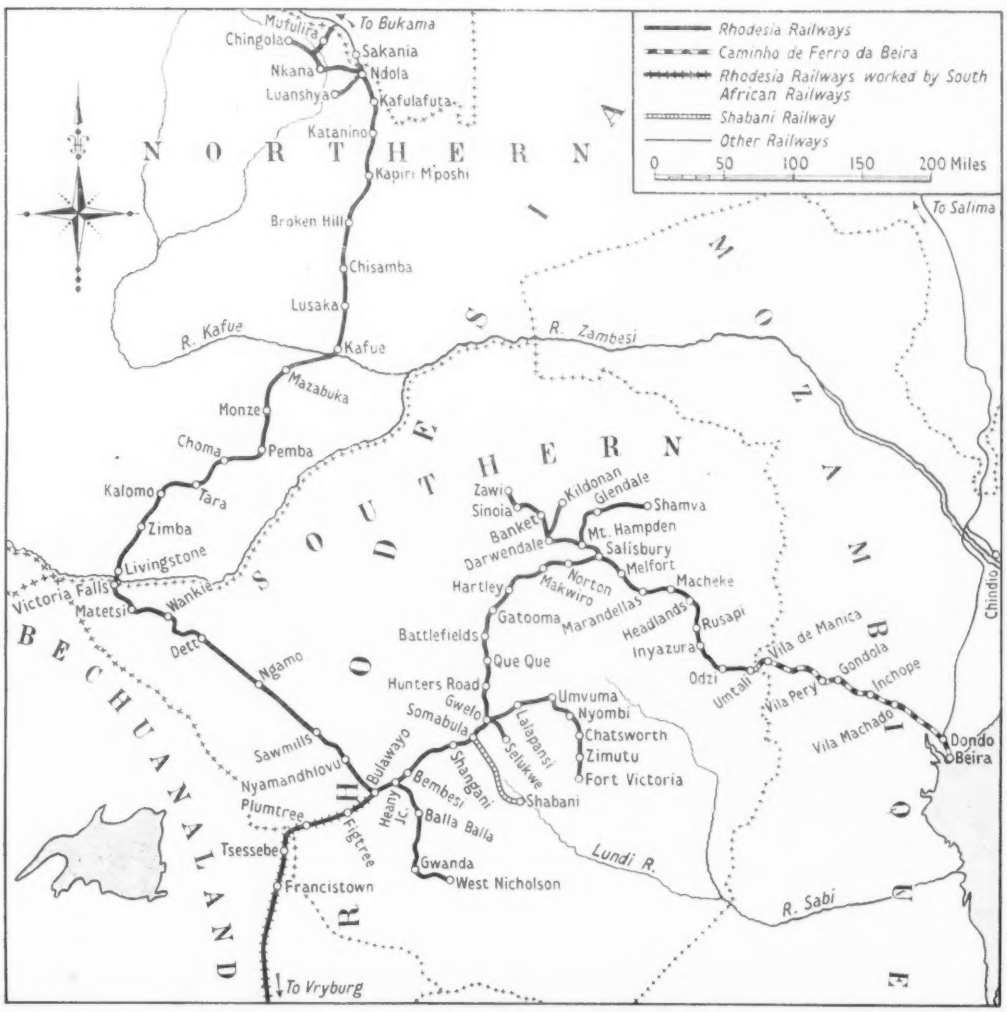
The following are the more important results:—

	1947-48	1948-49
Railways	(000)	
Train-kilometrage	4,730	4,676
Passenger journeys	3,725	3,340
Goods ton-kilometre	556,623	497,306
	(Iraqi Dinars 000)	
Coaching receipts	877	789
Goods receipts	2,313	2,290
Miscellaneous receipts	36	38
Total revenue from operation	3,226	3,117
Working expenses	2,988	3,122
Airways	(000)	
Passenger journeys	12·4	15·2
Revenue ton-miles (passenger, baggage, mails, and cargo)	439·2	683·2
	(Iraqi Dinars 000)	
Revenue	185·6	265·0
Expenditure	187·6	248·9

The tonnage of goods through booked from Syria increased by over 900 per cent., and goods booked to Turkey by 46 per cent. In the autumn of 1948, there was a movement of 30,000 tons of wheat from Syria, which resulted in a temporary wagon shortage, aggravated by a local coal shortage on the intermediate section of the Turkish State Railways concerned with this traffic. The through booking of goods to neighbouring States, however, generally worked satisfactorily throughout the year. As regards international passenger traffic, the report complains of delays to the "Taurus Express" at frontier stops, and restrictions on passenger travel west of the Bosphorus continued to rob this route of much of its significance.

Rolling stock put into service during the year included air-conditioned first and second class composite, and third class coaches, and also baggage and brake vans for the standard-gauge section, built by the Birmingham Carriage & Wagon Co. Ltd. and described in *The Railway Gazette*, June 30, 1950, issue. On the Kirkuk-Erbil Extension through linking to Erbil was completed in October, 1948. Heavy rainfall during the year caused breaches in various parts of the system, which were repaired with minimum interruption to traffic. Work on the new bridges over the Tigris and Euphrates and on the new terminus in Baghdad proceeded satisfactorily.

Iraqi Airways passenger and freight traffic fell short of estimates, and some services had to be reduced, mainly because of travel restrictions in the Arab States, where martial law was in force; even so, traffic increased by some 60 per cent. over the preceding year.



Map of the Rhodesian railways

The Rhodesia Railways

Large increases in passenger and freight traffic necessitate extensive engineering schemes and re-equipment programme

By F. E. Hough, O.B.E., M.I.Mech.E.,
Officiating General Manager, Rhodesia Railways

THE financial year ended March 31, 1950, produced new high records in traffic operations on the Rhodesia Railways, earnings for all sections (including the Vryburg-Bulawayo section operated by the South African Railways) totalling £9,939,095, an increase of £1,217,746 on the figures for 1949 (£8,721,349). Expenditure rose from £6,782,792 to £8,437,152 in the same period. The net operating revenue decreased by £436,614 on the 1949 figures.

Each class of receipts showed a marked increase over the corresponding period in 1949, and in particular earnings for general goods advanced from £4,702,399 in 1949 to £5,641,047 in 1950.

The total number of passengers carried increased from 2,307,177 to 2,374,222 with a substantial rise in African passengers from 2,005,971 to 2,086,431. The African is an inveterate traveller by rail, and the fact that of the 97 passenger vehicles the Rhodesia Railways have on order 59 are specially for non-Europeans bears this out. In addition to providing improved travelling facilities for Africans, the railways have introduced a scheme whereby specially selected Africans act as guides and helpers to their own people when travelling by train.

Tonnages carried in 1950 totalled 5,377,661 as against 4,725,066 in 1949, the most important increase being in general goods, which rose from 1,953,888 in 1949 to 2,276,807 in 1950. Coal and coke also showed a marked improvement, increasing by 197,608 tons from 1,706,105 tons in 1949 to 1,903,713 tons in 1950. Train miles increased from 6,818,559 in 1949 to 7,818,934 in 1950.

MINERAL TRAFFIC ON THE RHODESIA RAILWAYS

	1949 Tons	1950 Tons	Increase Tons
Chrome ore	248,399	296,405	48,006
Copper	295,823	341,301	45,478
Asbestos	71,199	82,105	10,906
Lead, zinc and vanadium ...	38,624	41,838	3,214
Other minerals	411,028	435,492	24,464

Staff Facilities

The rapid development of the territories served by these railways has necessitated bold planning. In its endeavours to attract the European staff required to work the railways (and the number of Europeans employed north and east of Bulawayo in 1949-1950 was 5,904, as against 5,065 in the previous year), the administration found itself confronted by a universal problem—an acute shortage of houses and accommodation for single employees. At the beginning of 1948 the total number of houses for married staff was only 997, and the number of rooms available for the unmarried staff and as rest rooms along the line was 678. By March 31, 1950, however, there were 1,371 houses available for occupation, with another 581 scheduled for completion by the end of the 1951 financial year. In the same period single quarters and rest rooms increased to 1,048, with another 295 sanctioned. An African housing programme was introduced in November, 1946, and by the end of March, 1950, 1,743 houses of various types had been erected.

To meet the demands on their services the Rhodesia Railways have on order 45 Beyer-Garratt locomotives of classes 15 and 16A; 110 coaches and vans of various types; and 315 wagons. In addition to the stock on order, tenders have been called for the supply of a further 12 milk and cream vans and 80 bogie cattle wagons. Of the 97 passenger vehicles on order the 34 third class and the 25 fourth class will be for the exclusive use of non-Europeans.

Marshalling Yards

Most of the programme of extensive engineering schemes required to handle the increased tonnages of traffic passing over the lines north of Bulawayo is now in hand, and is concentrated on the larger centres at Umtali, Salisbury, Bulawayo, Livingstone and Ndola. At Umtali considerable improvements to the east end of the yard have resulted in more efficient operation. New locomotive running and goods sheds are to be provided. A new marshalling yard at Lochinvar near Salisbury is in partial operation and will be extended. Connected with this is a scheme to divert the approach from Shamva and Sinoia from the northern and eastern suburbs of Salisbury to a route which will connect Mount Hampden Junction with the west end of Lochinvar yard. At Bulawayo reconstruction is in progress.

Que Que and Gwelo are to have additional traffic facilities in due course, and new yards are planned at Ndola. Deviations between Wankie and Dett, Kafue and Lusaka, and on the West Nicholson Branch and at Hunyani are in hand or under investigation.

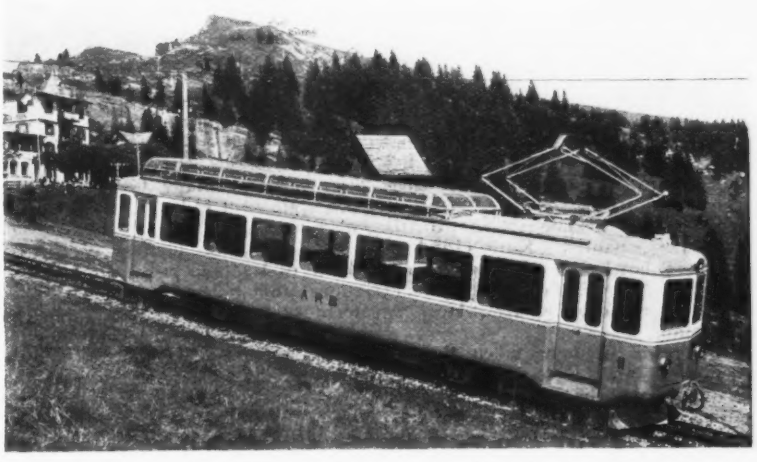
Centralised train control, which will assist in developing the capacity of the single track system, should be in operation between Heany Junction and Gwelo within the next twelve months. Mechanical and colour-light signalling is being introduced on an extended scale. In addition, extensive schemes are in hand for the mechanisation of those facilities dependent on African labour which at present is scarce. Contracts have been placed for the erection of coal-handling plants for the coaling of engines at Bulawayo and Salisbury.

On October 1, 1949, the operation of the railway between Beira and Umtali which had been performed by the Rhodesia Railways for many years, was taken over by the Caminho de Ferro da Colonia de Moçambique.

Though the Rhodesia Railways Road Motor Services continue to expand, the rising cost of maintenance is narrowing the margin between earnings and expenses, and therefore a surcharge of 5 per cent. on certain classes of traffic became operative from June 1, 1950.

No general increase in railway rates has been made for over ten years, and this has no doubt helped to check the rising cost of living.

New Stock for Arth-Rigi Railway



Railcar built by the Swiss Locomotive & Machine Works, Winterthur, for the Arth-Rigi Railway, Switzerland

PUBLICATIONS RECEIVED

The Devon Belle. By Alan Anderson. Famous Train Journeys No. 2. Leicester: Brockhampton Press. 7 in. × 5¼ in. 65 pp. Illustrated. Price 3s. 6d. —Introduced in 1947 to provide a fast summer service to the West Country and relieve the "Atlantic Coast Express," the all-Pullman "Devon Belle" with its special observation car, passes through some of the most interesting places and finest scenery in the south and west of England.

The author has done well to select this as the second in his series of famous train journeys. By skilfully weaving together a description of the train itself and giving glimpses of the work that goes on behind the scenes on the railway to make such a journey possible at all, with interesting facts about the countryside to be seen on the journey, the author has succeeded in producing a book equally satisfying to the railway enthusiast or the ordinary traveller.

Oesterreich's Lokomotiven und Triebwagen in Wort und Bild (*The Locomotives and Railcars of Austria Described and Illustrated*): Special number of the monthly journal *Eisenbahn.* 92 pages. 12 in. by 8¼ in., 113 photographs, 19 drawings, and tables of types and dimensions. Published by Ployer & Company, Vienna, 1949. Price, 15 Austrian shillings. The locomotive history of the Austrian railways is full of interest, and several great names in the front rank of locomotive designers are to be found associated with it. Not much information has been made available in England, however, beyond occasional descriptions of new engines in a number of specialised journals.

The name best remembered here is that of Karl Gölsdorf, son of a former locomotive engineer of the Austrian Southern line, Louis Gölsdorf, who, after being some years in industry, became locomotive engineer of the State Railways. In that capacity he produced some of the finest designs ever seen on the Continent. In this excellent issue Herr Stockklausner has brought together a splendid selection of photographs of the principal types of locomotive, steam, electric, and diesel, with some of railcars, and has dedicated the collection to three engineers who have shaped the development of the locomotive in Austria since 1893, namely, Karl Gölsdorf, Johann Rihosek, and Rudolf Sanzin. There is an introduction by the present Chief Mechanical Engineer, Herr A. Guttmann.

The reader is here taken through the entire series of locomotives, with details of the characteristics of each and the class of work it was designed to perform, with the reasons for the adoption of any special features of the engine in each case. The Austrian locomotives had a distinct appearance and characteristics of their own, largely the result of having to meet special conditions, such as types of permanent-way, construction gauge, and other local circumstances. Many of Gölsdorf's machines were beautiful in appearance. Students of locomotive engineering and running will find this work of great interest. The whole forms a tribute, not only to the skill of the Austrian locomotive designers, but also to that of the manufacturing firms who built the engines. The author has also included a number of locomotives of foreign origin, as for example, those brought into Austria after the lines there were incorporated in the German Reichsbahn, and others which came to work there after the arrival of the Allied Forces, such as the American war locomotives.

Géographie des Chemins de fer Françaises. Vol. I, Part 4. France Lointaine. (Geography of the French Railways, Vol. I, Part 4. French Colonial Territories.) By H. Lartilleux. Paris: Librairie Chaix, 20, Rue Bergère, 9e. 11¼ in. × 8 in. 232 pp. Fully illustrated. No price stated.—In this part of his encyclopædic work, the author extends his survey to railways in French possessions overseas, adopting the same system of topographical description, combined with an outline of characteristic operating features, as in previous volumes. Here he has much picturesque material to draw on, and in bringing it to life for the stay-at-home reader is helped by a choice of illustrations that gives an impression of local architecture, scenery, and population as well as of technical railway details. Railways in North Africa have been dealt with in a previous book (Part 3 in the series), so Part 4 begins with the systems of French West Africa, continuing eastwards to French Equatorial Africa, Abyssinia, Madagascar, Reunion, French Indo-China, and possessions in the Pacific and West Indies.

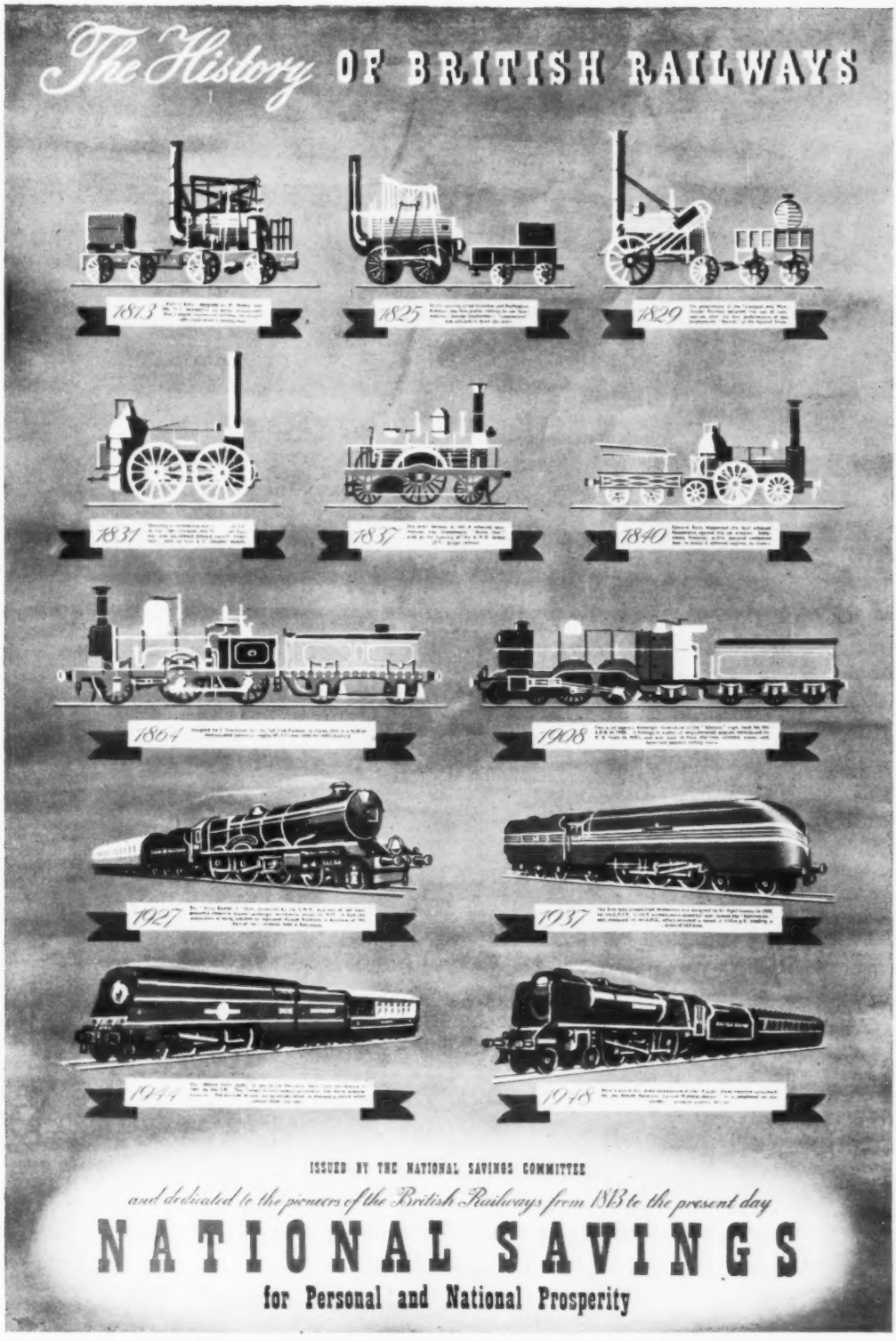
There are several whole-page maps in colour, and sketch maps in black and white of individual railways. Gradient profiles are included of the more precipitous routes, such as the Yunnan line, with its 50 miles mostly at 1 in 40 after entering the Chinese province of that name. Civil engineering details naturally figure largely in descriptions of railways in such varied surroundings, and one of the many unusual points of interest is that the island of Reunion possesses the longest tunnel (6·6 miles) entirely on French territory, if its three successive sections are counted as one. Among the many operating particulars in the book is the fact that the Franco-Ethiopian Railway is seeking to encourage tourist traffic to Abyssinia and now runs a sleeping car train three times a week from Djibouti to Diredawa, connecting there with a railcar to Addis Ababa so that the whole journey from coast to capital can be made in 22½ hr. A five-page index enables the user to turn up at once the reference to any station mentioned, but we are sure that for every reader seeking specific information regarding, say, An-Lac, Ban-Sot, or Cha-Pa, hundreds will be satisfied to browse at random among the mass of picturesque railway information in this book.

L'Opinion Economique et Financière, Edition Illustrée (juillet 1950): *Le Chemin de Fer de* 1950. Paris 19e, L'Opinion Economique et Financière, 1, Rue St.-Georges. 80 pp. Illustrated. Price 375 francs.—This special issue of *L'Opinion* includes a preface by M. Louis Armand, Director General of the French National Railways, and a series of short, penetrating, and well illustrated studies of French railway activity, such as electric locomotives, diesel traction, passenger traffic, refrigerator vans, private sidings, and automatic signalling; the emphasis is on mechanical and civil engineering rather than on operating, commercial, or other aspects, and there is special reference to the Paris-Lyons electrification.

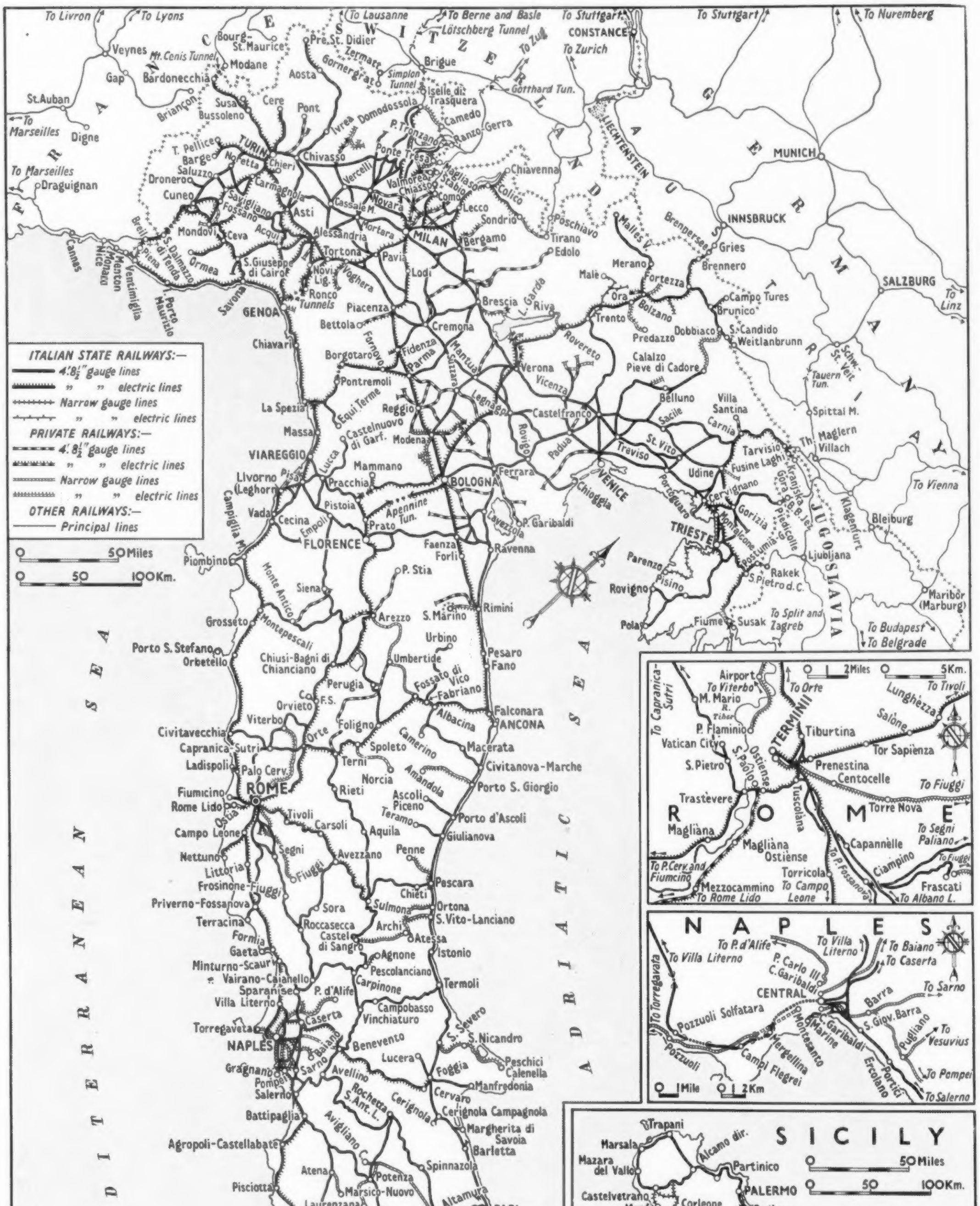
A Centenary Catalogue.—An illustrated catalogue, with a brief account of the history of the firm, has been published by the exors of James Mills Limited, Bredbury Steel Works, Stockport. The book also contains descriptive matter dealing with various products and their application and compares the properties of standard steels and Mills Ledloy steels. The catalogue also contains much useful data and tables, notes on welding of Mills steels and a glossary of technical terms. The firm has also published a catalogue dealing with railway permanent way fastenings and their method of application and a further catalogue dealing with the manufacturing and application of grooved pins and studs.

Production of Aluminium Alloy Castings.—Producers and users of aluminium alloy castings will find material of considerable interest in Bulletin No. 17 of the Aluminium Development Association, 33, Grosvenor Street, London, S.W.1, which is published at 1s. This is written from a practical point of view and describes and illustrates briefly the foundry processes necessary to the production of castings. The subjects dealt with include the characteristics of aluminium alloy castings and their uses, casting methods, different types of castings, and mechanical methods adapted in modern foundries. Other subjects include gravity and pressure die-casting, core making, specification references, and the design of castings as well as methods of inspection. Also included is an appendix containing specified composition and mechanical properties together with a list of previous publications.

THE SCRAP HEAP



Reproduction of colour poster issued by the National Savings Committee and depicting a century of progress in British locomotive design



The railways of Italy, showing the extent of electrification

The Italian State Railways

Rapid post-war rehabilitation, but financial difficulties caused mainly by unrestricted road competition

By G. di Raimondo,
Director-General, Italian State Railways

Adhesion railcar for narrow-gauge lines in Sicily with gradients up to 1 in 13

ON their formation in 1905, the Italian State Railways took over some 8,000 miles of track from the various private companies, with a very limited amount of rolling stock and stores. In subsequent years the system was extended, and by 1939 was one of the leading railway systems in Europe. It then comprised some 10,000 miles of line, including the new direct lines from Rome to Naples (*the Direttissima*) and from Florence to Bologna through the Apennine Tunnel; 3,500 miles of electrified line; 570 miles of tunnel; 2,729 stations; 145 locomotive depots; 19 principal rolling-stock workshops; 12 main power stations and sub-stations; 4,000 steam and 1,400 electric locomotives; over 200 multiple-unit electric trains and 800 petrol and diesel railcars; 12,000 passenger coaches and vans; 137,000 goods wagons; and six train ferries. Staff quarters totalled 16,226 and welfare measures included five schools for railwaymen's children, 22 sea and mountain holiday camps, and 273 *Dopolavoro* ("after work") social and recreation centres. Between 1909 and 1939 statistics show a rise of 70 to 120 million train-miles annually, of 3·5 to 8 milliard ton-miles, and of about 3 to 7 milliard passenger-miles. The operating ratio for 1938-39 was 82 per cent., and results of working showed a favourable balance of 213 million lire.

War Damage

The damage sustained in 1940-45 varied in accordance with the intensity of the fighting in different districts. From Sicily to the Volturno Line (Caserto-Termoli) the damage suffered was caused almost exclusively by aerial bombardment; thence to the Gothic Line (Viareggio-Bologna-Rimini), where some of the most bitter and long drawn-out fighting took place, many lines were almost totally destroyed, being the objectives of air and land attacks by both sides, and were also systematically demolished and stripped of equipment by retreating German troops. North of the Gothic Line, apart from the scenes of brief violent encounters, destruction was less widespread, chiefly from aerial attack; but these areas included some of the largest bridges which suffered great damage. In all, some 20 per cent. of the pre-war track mileage, 28 per cent. of masonry and 45 per cent. of steel bridges, 40 per cent. of workshops, station and other buildings, 90 per cent. of overhead equipment for electrified lines, and 50 per cent. of signal and telegraph lines and installations were destroyed or badly damaged. Of rolling stock, 67 per cent. of electric locomotives, 56 per cent. of steam locomotives, 82 per cent. of multiple-unit electric trains and railcars, 80 per cent. of other passenger coaches and vans, and 60 per cent. of goods vehicles were destroyed, in addition to all the train ferries. Thus the total damage suffered by the Italian State Railways amounted to over 40 per cent. of their total plant.

Reconstruction

As the war crept up the Italian peninsula, sections of line were re-opened to service and skeleton services resumed in an attempt to alleviate the situation of the local population. With the aid of their considerable resources, the Allies succeeded in a short space of time in re-establishing services along the main longitudinal lines for the maintenance of their forces. Much work, however, was necessarily done hastily and not in accordance with the Italian State Railways' peace-time standards. For example, bridges on the Rome-Naples line were replaced by embankments which soon crumbled, and in the Apennine Tunnel on the Bologna-Florence direct line a considerable length at the

Bo-Bo passenger locomotive for main-line working

south end was re-opened to traffic with clearance only for a single track.

From 1945 onwards (except for a few bridges and viaducts where reconstruction had to be of a temporary nature) repaired or renewed formation, masonry bridges, and other works, were all of a permanent nature, and these were given priority over many other public works. In civil engineering works, improvements include the easing of gradients and flattening of curves; relaying with 120-ft. 120-lb. rails; thermit welding of existing 40-ft. and 60-ft. rails to give 430-ft. lengths in tunnel. Reinforced concrete bridges have been made lighter, with permissible loads increased by 30-50 per cent. Several tunnels have been enlarged before doubling of track or electrification. Signalling developments comprise extension of the automatic block system, and installation on the Arona-Domodossola and Bologna-(Apennine Tunnel)-Florence lines of power-interlocking boxes fitted with route levers.

Electrification

It is perhaps in electrification that the Italian State Railways have made the most noteworthy progress. In 1898, after experiments with battery locomotives and the third-rail system, the former system was abandoned and the latter not proceeded with; that subsequently favoured by the State Railways was three-phase low-frequency with overhead contact lines, first introduced on the Lecco-Chiavenna line in 1902, and later extended to various lines in Northern Italy. In 1927, the 3,000-V. d.c. system was experimented with in the South, and 45-cycle 10,000-V. three-phase on a Rome suburban line. The former system was adopted in the project which had increased the electrified mileage to 3,500 by 1943.

The war, however, destroyed most of the existing electric installation, and it was necessary to choose between 3,000-V. d.c. and high-tension single-phase a.c. at 10,000-15,000 V., as used in Switzerland and elsewhere. The existence of some undamaged plant and rolling stock swung the balance in favour of the existing system, and the opportunity was taken to unify electrification over all lines. Three-phase sections which had been destroyed were re-equipped with 3,000-V. d.c., and later the undamaged and less damaged lines were converted. After the war, the Domodossola-Milan section (on the "Simplon-Orient Express" route) was electrified. Electrification is now in progress of lines in Sicily. The lines now electrified amount to one-third of the whole system, and over three-quarters of these are on the 3,000-V. d.c. system. Some use is made of geothermic current, which was the subject of an article in *The Railway Gazette* issue of January 20, 1950.

Steam locomotives are not included in new building programmes, though some existing locomotives are to burn naphtha and mixed naphtha and coal fuel. New multiple-unit electric train sets for fast long-distance services (*elettrotreni*) have the motormen's compartments in the upper part of the vehicle, to leave room for observation compartments; they can attain a speed of 100 m.p.h. Light-weight third class passenger coaches incorporate special light alloys, plastics, and new methods of springing and sound-proofing, and ride smoothly at 90 m.p.h. In passenger stock working over electrified sections electric heating is being installed at 3,000 V.; the amount can be transformed to 1,500 V. for running over electrified lines using the latter voltage. All new freight rolling stock and a proportion of rebuilt wagons are fitted with continuous brakes and roller axle bearings.

With the opening of the larger bridges across the Po, the work of repair and rehabilitation is almost at an end. The proportion of damaged steel bridges, however, in need of repair is still 13 per cent., and that of signal equipment 25 per cent. The number of passenger vehicles of all types is 37 per cent. below the pre-war figure. The fleet of ferry-boats and steam vessels owned by the State Railways is now above pre-war strength and has been modernised.

The budget alone cannot cover the heavy cost of railway rehabilitation; like that of many other European railways it has resulted in a deficit which constitutes a grave financial problem. If, however, the work undertaken had been interrupted for financial reasons, there would have been marked depreciation of what had already been done, and the deficit would have been increased. Rationalisation is the only remedy. In

New ferryboat "Mongibello" of 2,600 *tons on Straits of Messina service, capacity* 18 *wagons and* 500 *passengers*

other words, where it has not been found possible to subsidise all reconstruction and modernisation completely, losses on working must be minimised. The authorities are well aware of these alternatives, and it is hoped that a satisfactory solution will be achieved.

The tables below show that the speed of passenger and goods trains is now comparable to that before the war.

SHORTEST PASSENGER TRAIN JOURNEY TIMES

Between	and	Miles	Dec., 1938	Oct., 1945	May, 1950
			hr. min.	hr. min.	hr. min.
Milan...	Domodossola	78	2 11	4 45	1 33
Milan...	Rome ...	395	6 00	32 59	6 35
Milan...	Venice ...	167	2 58	7 40	3 08
Bologna	Bari ...	405	10 10	26 05	9 11
Rome	Naples (*via* Formia)	131	2 00	6 30	2 11
Naples	Messina ...	293	6 37	12 40	7 50

SHORTEST FREIGHT TRAIN JOURNEY TIMES

Between	and	Miles	May 1939	May 1947	May 1950
			hr.	hr.	hr.
Villa San Giovanni*	Chiasso ...	850	40	63	38
Bari	Brennero	555	40	71	40
Villa San Giovanni*	Trieste ...	870	44	73	44

* Mainland terminal of the train ferry to Messina

Wagon turnround, which in 1938-39 averaged 7 days 19 hr., was reduced in April, 1950, to 7 days 6 hr. In the past ten years passenger traffic has increased 88 per cent., and goods traffic has fallen nearly 14 per cent. The increase of the former is ascribed in part to a natural desire to travel after wartime restrictions on freedom of movement, which was also necessary for the reactivation of commerce and industry; the drop in goods traffic was due to decreased production and to increased road competition.

To reduce the gap between revenue and expenditure, seven tariff increases have been put into effect since November, 1944. Increased road competition, aggravated by the freedom of road transport from Governmental restrictions, rendered advisable a rise in the lower and reduction of the higher freight rates, on which latter the effect of road competition was more marked. A feature of recent tariff alterations is the rebate for distances of over 625 miles in passenger and 375 miles in goods traffic, to overcome the disadvantages imposed on the extreme north and south of Italy by the configuration of the country. Even the latest passenger and goods tariff increases, however, have resulted in transportation costs which, compared with the pre-war figures, are 50 per cent. lower than the average cost-of-living coefficient, which stands at 1:50. Compared with other European railways, the Italian State Railways tariffs are the lowest.

Decrease in Revenue

In addition to the yields from increased tariffs, it was thought recently that there would also be an increase in goods traffic, in view of the improved general economic condition of the country. The first ten months of the 1949-50 statistical period did not see this hope realised. Not only was there a drop in the general volume of traffic, after a deterioration in the national economy, but there was also a marked reduction in rail traffics over short and medium distances, in other words, over the distances mainly affected by the increased tariffs. To meet this situation, the following steps were taken: (*a*) reduction in tariff according to distance, type and dimensions of goods; (*b*) increased use of private sidings; (*c*) door-to-door collection and delivery services; and (*d*) use of containers. These measures have already given good results, but the decline in traffic still remains serious.

The State Railways cannot be considered as a purely commercial enterprise. Many functions and services connected with Governmental activities compel it to perform uneconomical services, both passenger and goods, in the interests of the community. Balancing the budget in such conditions becomes almost impossible. One of the means of so doing would be increased revenue from increased traffic, whilst another would be reduction of operating costs. There are, however, many technical factors which militate against the latter.

Balancing the budget is subordinated to fresh appropriations for the completion and modernisation of the system, and it is problematical whether the measures outlined above will suffice for stable equilibrium in these days of unrestricted transport in Italy. The Italian State Railways are among the very few state railway undertakings in the world that are completely unprotected. They must face road transport competition in a country where road transport is highly developed and cheap to operate; and the railways can only compete by transport in bulk. This situation is well known to the Italian Parliament and Government.

The Holy Year

Mention must be made of the participation of the Italian State Railways in the Jubilee Year celebrations which are drawing crowds of pilgrims and other visitors to Rome. Acknowledgement is due to the co-operation of the railway administrations of Austria, Belgium, France, Germany, Great Britain, Luxemburg, Holland, Spain, and Switzerland. These systems accepted the invitation of the Italian State Railways to the conference held in Rome in July, 1949, which determined the plan for handling pilgrim traffic during the Holy Year.

This plan, which has successfully withstood the test of some nine months, included: (a) the setting up of a special office by each railway concerned; (b) indication by the Italian State Railways of the maximum permissible loads over the principal lines used for pilgrim traffic; (c) working over the Italian lines

Electric railcar for high-speed services

Desenzano Viaduct on Milan-Venice line rebuilt in reinforced concrete

of special trains and coaches, with arrangements for return of stock to the owning railways; (d) new ordinary services, introduced in the summer timetable on May 14, 1950 (one pair of trains by each route), between Paris and Rome and Bordeaux and Rome *via* Modane, between Metz and Turin (summer only), between Amsterdam and Rome *via* Strasbourg and the Gotthard, and between Lyons and Rome *via* Modane (summer only); (e) acceptance at frontier stations, even without previous arrangement, of special coaches conveying parties, and their onwards working by the next available ordinary passenger train.

Fare concessions in force until December 24, when the Holy Year ends, include 40 per cent. reduction on ordinary tickets to Rome and on circular tour tickets including Rome in the itinerary; and reduction of 50 and 60 per cent. for parties of 51-750 and of over 750 respectively.

Heavy Pilgrim Traffic

Pilgrim traffic since December, 1949, with its peak at Easter, may be gauged from figures to the end of May, 1950: special train arrivals 259, departures 240; Italian State Railways' special coach working arrivals 1,956, departures 1,936; foreign railway special coach working arrivals 1,589, departures 1,561; of passengers by the foregoing 235,363 arrived and 234,611 left; in addition, over 450,000 individual passengers arrived at and departed from Rome Termini Station on the occasion of special visits to Rome in the Holy Year.

The Italian State Railways, through their enquiry offices and train and station staffs, gladly offer their assistance to travellers from abroad. To these very welcome guests and to those who will follow in the next few months they extend their greetings.

The Vatican Railway

A standard-gauge line and terminus in the smallest State in the world

THE Vatican State, with an area of 109 acres and a resident population of about 1,000, owns a standard-gauge double-track railway line and also its own station, built in compliance with the Lateran Treaty between the Holy See and the Kingdom of Italy, signed on February 11, 1929; this provided for construction by the Italian State Railways of a branch line connecting the new Vatican State with the Italian railway system, and accorded the Papal special train extraterritorial rights and facilities over that system; while the Papal train itself was to be the property of the Vatican State, motive power was to be supplied by the Italian State Railways which were also to work the train.

Because of the situation of the Vatican State on the north-western outskirts of Rome, and its almost complete enclosure by mediæval walls, a connecting line had to branch off from the Rome-Viterbo line of the State Railways, which skirts the outer (western) boundary of the Vatican. Rome San Pietro, a small suburban station, is the junction from which the Vatican railway branches off northwards, rising to cross the Viale Vaticano, which runs along the Vatican walls, by means of a masonry bridge. At the eastern end of the bridge is a large steel gate with two sliding wings, in the Vatican wall. Up to this point the double-track line from San Pietro is owned by the Italian State Railways.

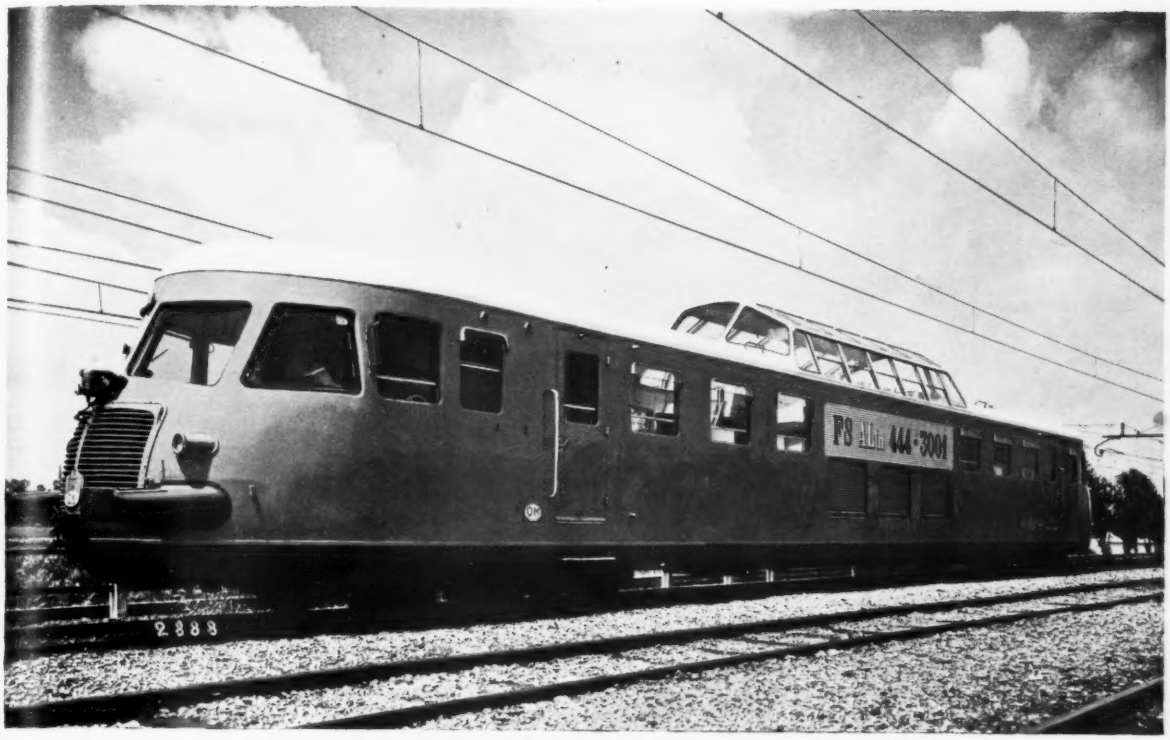
From the gate the line continues within Papal territory, turning north west for about 700 ft. A few yards from the gate, on the south-eastern side of the line, is the Vatican railway station, a one-storey building with a high central hall reaching to the roof and a canopy whose central part extends to the edge of the platform. Space limitations in Papal territory necessitated a retaining wall beside the second track opposite the station buildings. The two tracks end about 300 ft. from the station building in front of another retaining wall built in the rising ground of the Vatican gardens. A siding branches off halfway between the transverse retaining wall and the station building and ends at a buffer stop a few yards from the station building. The railway and station were completed in 1932.

Wagons from stations in Italy and abroad are worked daily over the branch, though many consignments for the Vatican State are unloaded at stations in Rome and conveyed thence by road. Traffic on an increased scale was handled over the Vatican line during the war years conveying foodstuffs for residents in the State and the many consignments by the Vatican of relief parcels for prisoners of war, displaced and other destitute persons, and so on.

The railway has almost never carried passengers. The Papal train, consisting of three coaches, including one with a Papal throne, is obsolete, and is said to be the train by which Pope Pius IX left Rome in 1870 by rail for Civitavecchia, where he embarked for Gaeta. The journey to the Papal summer residence at Castelgandolfo, in the Alban Mountains, is now made by road.

The first railway in the former Papal States was built in 1851. The 15-mile line between Rome and Frascati, in the Alban Mountains, was completed in 1857, and by 1861 the Papal States comprised a railway system of 63 route-miles, whilst 93 route-miles were building, and a further 28 were planned. These lines were mostly owned and worked by private companies, though all concessions had to be obtained from the Papal administration which pursued a progressive policy as to the development of railway transport. In 1873, the State Railways in the newly-created Kingdom of Italy purchased the Ferrovie Romane railway system from the railway company of that name which, formed in 1867, had absorbed the railways located in the Papal States.

Observation Railcar, Italian State Railways



Railcar with observation dome for passengers

Interior of railcar, showing armchair seats and upper saloon

Modern Italian Station Architecture

Facade of Verona Station, rebuilt since the war

New passenger terminus at Rome, where the Fifteenth International Railway Congress is being held from September 25 to October 4

The Vatican Railway

(See article on page 282)

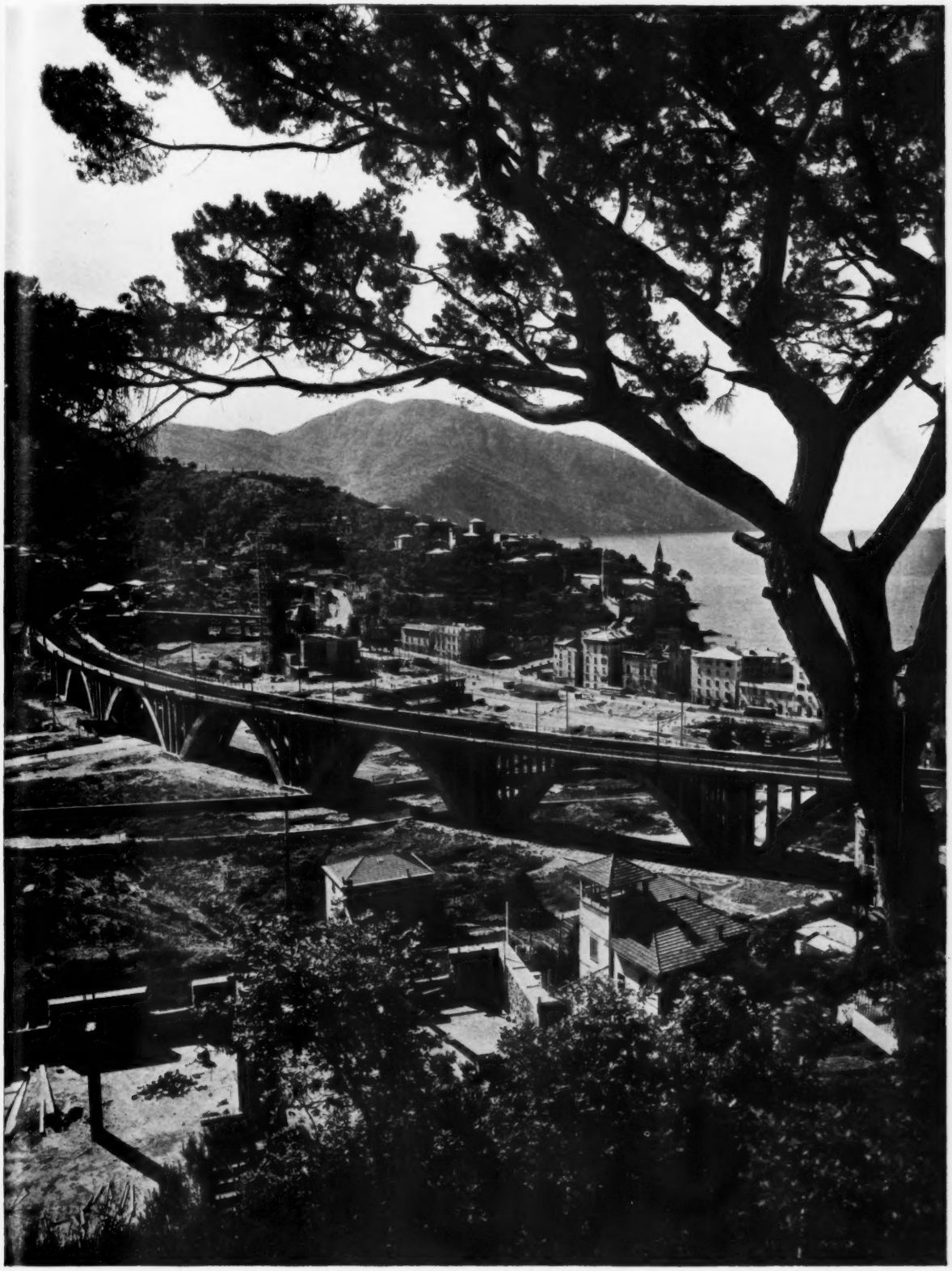
Entrance through Vatican wall to station, showing sliding wings

Vatican station building and (right) gardens

New Marshalling Yard, Italian State Railways

New yard at Bologna, one of several rebuilt and remodelled after being heavily damaged during the war

Bridge Reconstruction on the Italian State Railways



Reconstructed viaduct at Recco on Genoa-Spezia line, which was severely damaged during the war

Altamont Tunnel, Union Pacific Railroad

A single-line tunnel, which duplicates an existing tunnel, removes a bottleneck on a transcontinental main line

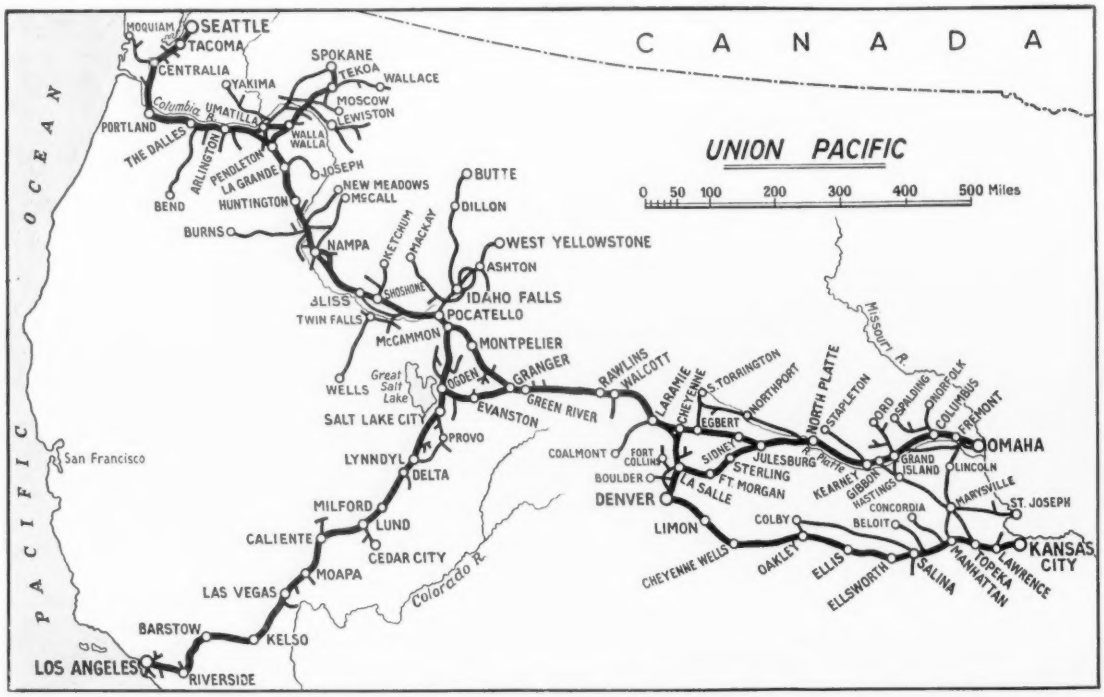
THE most serious obstacle encountered by the engineers of the Union Pacific main line through Wyoming was the Uintah range. Through it they bored a single-line tunnel, opened for traffic 48 years ago, known as Aspen tunnel, located between Granger and Evanston. Since then increasing traffic has necessitated doubling of the whole of the 1,026-mile section from Omaha to Salt Lake City with the exception of the mile-long section through this tunnel, which therefore became a bottleneck. Due to its geographical position this affected not only the route mentioned, but others also, as seen in the map below.

So greatly did this single-line tunnel section impede operation that it was decided to construct a duplicate single-line tunnel; work began in the Spring of 1947. The urgency of the undertaking called for construction 24 hours a day and seven days a week; on November 9, 1949, the new tunnel, known as Altamont, was officially opened.

The new tunnel parallels, and is to the north of, the old Aspen tunnel, at an altitude of 7,200 ft.; the mountain ridge is some 460 ft. higher at this point. Eastbound traffic continues to use the Aspen tunnel. Though only 6,705 ft. long, the Altamont tunnel and approaches cost $8,000,000. The most important work in the eastern approach is a 2,000-ft. embankment, that absorbed 250,000 cu. yd. of fill and has a maximum height of 50 ft. The western approach contains an 80-ft. cutting, for which much the same excavation was necessary.

Tunnelling was carried out from both ends, but whereas full-face excavation (26 ft. height and 18 ft. 6 in. wide) proceeded at the eastern face, a top heading only was driven in the first instance at the western face, enlargement to full section following later. Normal methods of drilling, firing and mucking were used. Diesel and electric locomotives were used to haul the tip or hopper trucks of excavated material to the dump outside the tunnel.

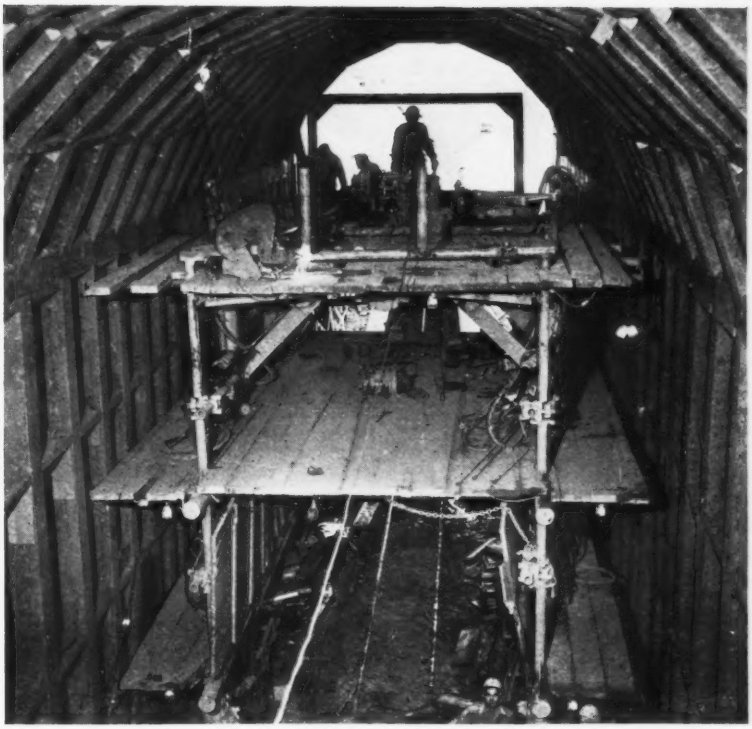
Shoring with timbers and steel ribs followed the mucking, and was in turn



Union Pacific System. The new Altamont Tunnel is situated between Evanston and Granger, where the two main lines from the west converge

followed by the placing of steel reinforcement for the concrete lining; this steelwork amounted to 5,000 tons. Concreting began in the spring of 1949, some months before excavation was completed; the quantity used was 60,000 cu. yd.

Construction was under the general supervision of Mr. W. C. Perkins, Chief Engineer, Union Pacific Railroad. For the foregoing information and accompanying illustrations we are indebted to our American contemporary *Railway Age*.



One of the "jumbo" stagings used in the construction of Altamont Tunnel as seen from the working face

Royal Train on the Western Region

Down Royal Train passing West Drayton on July 10, 1950

Photo] [*D. J. Skinner*

New Coaching Stock for the "Powhatan Arrow"

Lightweight "coaches," dining cars and observation cars for the steam-hauled crack expresses of the Norfolk & Western Railway

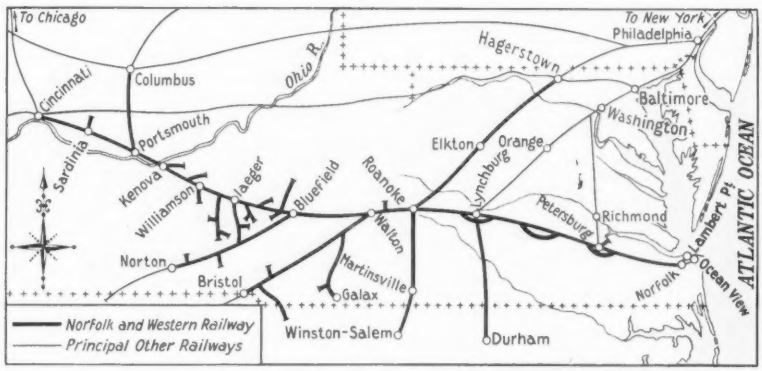
AT the end of 1949 the Norfolk & Western Railway put into service two new ten-coach trains for working the "Powhatan Arrow" between Norfolk, Virginia, and Cincinnati, 676 miles. Though the ten vehicles weigh 683·6 short or 610·4 long tons, they are classed as lightweight, and each measures 85 ft. over couplers and makes full use of the liberal American loading gauge. The east- and westbound "Powhatan Arrow" expresses are both day trains, taking 15 hr. 35 min. and 15 hr. 45 min. respectively for the journey, and the new stock consists of seven day coaches—five with all-"coach" seating, the sixth including two compartments, and the seventh a composite "coach"—smoking lounge-staff-locker car—two dining cars, and a lounge-tavern-observation car.

The total seating capacity, including the diners, lounges and compartments, is 520, so that the tare weight per passenger is 1·17 long tons, a figure largely accounted for by the extensive and heavy equipment carried. This includes complete air-conditioning in the form of Vapor train heating and Frigidaire air cooling controlled thermostatically, the switch over from heating to cooling and *vice versa* being entirely automatic. There is an eight-ton compressor and condenser under each vehicle. The doors all have electro-pneumatic control acting automatically at a touch, and the door action is timed to conserve conditioned air in each vehicle. Ample staff accommodation is provided for a hostess, steward and the dining-car attendants, and the kitchen equipment is elaborate.

The seats in the coaches are of the rotating and reclining type, spaced 3 ft. 5 in. apart, and rubber-covered free-turning foot rests are fitted to the backs of the seats and are adjustable to four positions. Individual arm-chairs are provided in the observation lounge. Each coach has a baggage compartment for heavy luggage and separate retiring lounges for both sexes. Lighting is fluorescent, upholstery lavish, and special attention has been paid to colour schemes in each vehicle.

Though some aluminium was used in the construction of the coaches, they are built mainly of low-alloy high-tensile steel and are all-welded. A feature of the design is the use of large fog-proof picture windows. Weights of individual vehicles vary from 64 long tons for the dining cars to just under 60 tons for the coach-staff-locker car.

The schedules for these trains give an overall speed of only 43 m.p.h., but there are 14 intermediate stops in each direction of up to 10-min. duration, and much of the line is heavily graded and extensively curved. The "Powhatan Arrow" is worked throughout by J class 4-8-4 locomotives, but engines are changed at Roanoke, 252 miles from Norfolk and 424 miles from Cincinnati.



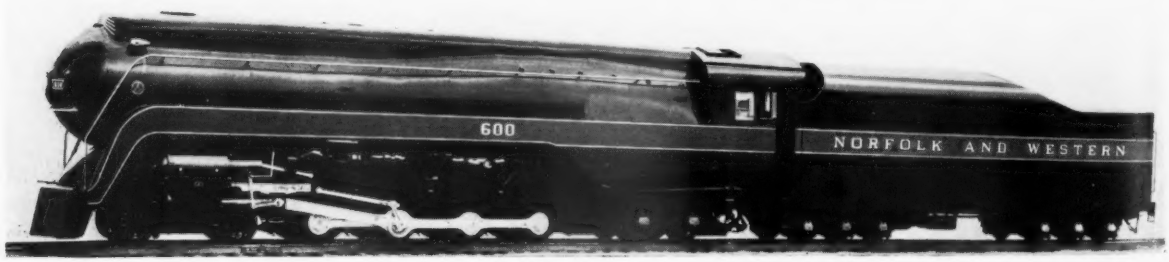
The Norfolk & Western Railway and connections

Intensive Engine Use

Efficient steam operation is a speciality of the Norfolk & Western, and on the latter engine-run remarkably intensive use has been achieved in that a four-engine link is responsible for running 10,176 miles every four days. Each of these engines covers 2,544 miles in three return trips within 87 hr., with turn-round standing time at the end of each 424 mile run of only 2 hr., 2 hr. 35 min., 6 hr. 15 min., 2 hr. 30 min., and 2 hr. 45 min., or 16 hr. 5 min. in all in shed. It then has 9 hr. in shed at the end of the 87-hr. cycle to complete the four days' routine and before beginning the next similar cycle. Individual engines average 18 return trips or over 15,000 miles a month.

These short turn-round times after such long continuous runs are made possible by the installation of every refinement in servicing at specially-designed running sheds and yards. Most of the ordinary servicing duties are performed simultaneously, and a special building, equipped with a network of pipes through which oil and grease are forced under pressure, supplies the 220 lubricating points on each engine. As these engines can run 1,300 miles on one filling of its lubricators, replenishment is not necessary after every run.

The railway designs and builds its own locomotives at Roanoke. The J class has 27-in. × 32-in. cylinders, 5 ft. 10 in. coupled wheels, boilers pressed to 300 lb. per sq. in., and a nominal trac-



Class "J" streamline 4-8-4 locomotive, used for hauling the "Powhatan Arrow," Norfolk & Western Railway

The "Powhatan Arrow" passing through picturesque country on its 676-mile run between Norfolk and Cincinnati

tive effort of 80,000 lb. Of a total weight of engine and tender of 390 tons, 128 tons are available for adhesion; the overall length is 109 ft.

On dynamometer-car trials, the J class engines hauled 15 vehicles weighing 1,025 tons, and on the 1 in 77 upgrades maintained 40 m.p.h.; the drawbar h.p. then recorded was 5,000 and the highest attained on all sections was 5,300. Very high speeds are reported to have been maintained on the level even with this load. The steepest section in the Allegheny mountains on this route has a ruling gradient of 1 in 50, which is almost continuous for 20 miles. This section is electrified but only coal trains are electrically-worked over it. The J class engines work the "Powhatan Arrow" expresses single handed. Judging by the results of the trials briefly mentioned above, they should handle the new 683-ton trains with ease.

Baldwin 4-8-2 Locomotive for the Argentine

One of a series of 30 4-8-2 locomotives built by the Baldwin Locomotive Works for the Argentine State Railways, for freight service on the metre-gauge lines. They have 19¾-in. by 26-in. cylinders, 4-ft. 2-in. dia. coupled wheels, and a tractive force of 31,800 lb.

Public Day at the Royal Engineers Transportation Centre

Headquarters and part of the parade ground of the R.E. Transportation Centre, Longmoor

0-4-2 *locomotive, "Gazelle," now on permanent loan to the Centre, and* 2-10-0 *locomotive, "Kitchener"*

(Left) removing pair of wheels from, and lowering end of, well wagon to form loading and unloading ramp; (right) tank being driven down the ramp